Instrument Accommodation on the Pioneer Venus and Galileo Probes

Bernie Bienstock
Jet Propulsion Laboratory
California Institute of Technology
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General Instrumentation Accommodation Requirements (1)

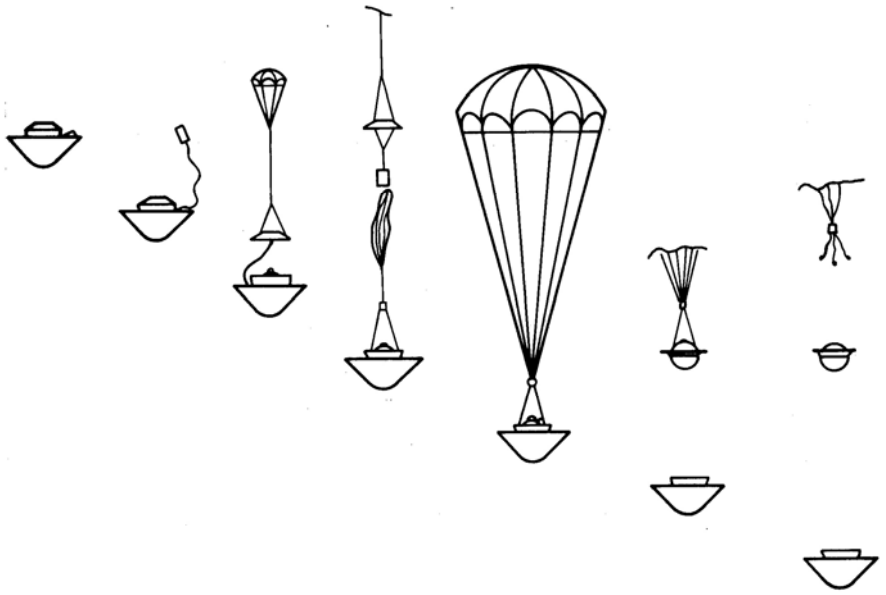
- Most instruments require “normal” housekeeping support from probe subsystems
  - Power
  - Thermal control
  - Telemetry and command functions
- Entry probes, with in-situ instrumentation, require additional support that may include some or all of the following services
  - Field-of-view through windows
  - Atmospheric ingestion and expulsion
  - Dynamic / static mounting requirements
  - Deployments
  - Magnetic cleanliness
  - Outgassing and contamination control
  - EMI/EMC analysis
  - Microphonics

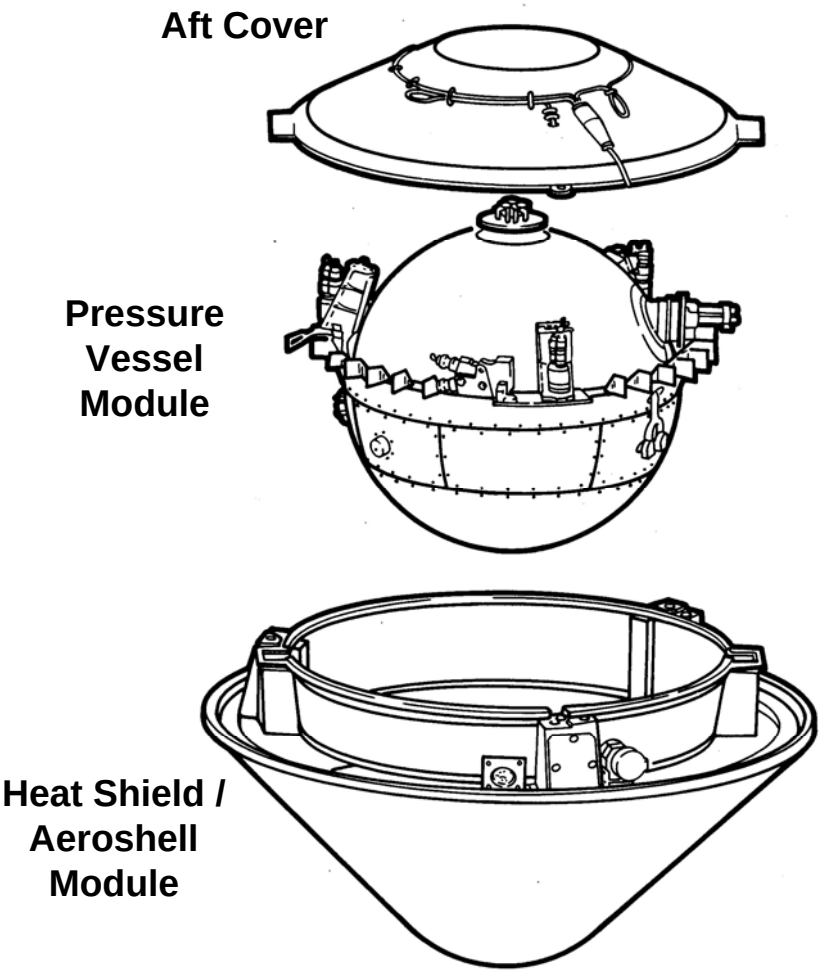
General Instrumentation Accommodation Requirements (2)

- Instrument accommodation complexity is driven by probe design philosophy
  - Pressurized probes, such as the Pioneer Venus Large and Small Probes, require the probe pressure vessel itself to provide the viewing and sampling access for the instruments
  - A “vented” probe, such as the Galileo probe, allows instruments to incorporate external atmospheric sampling and viewing within the instrument
- With any entry probe design, instrument accommodation requires a continuing, design coordination between the probe science PI(s) and the probe engineers

Pioneer Venus Large Probe Design

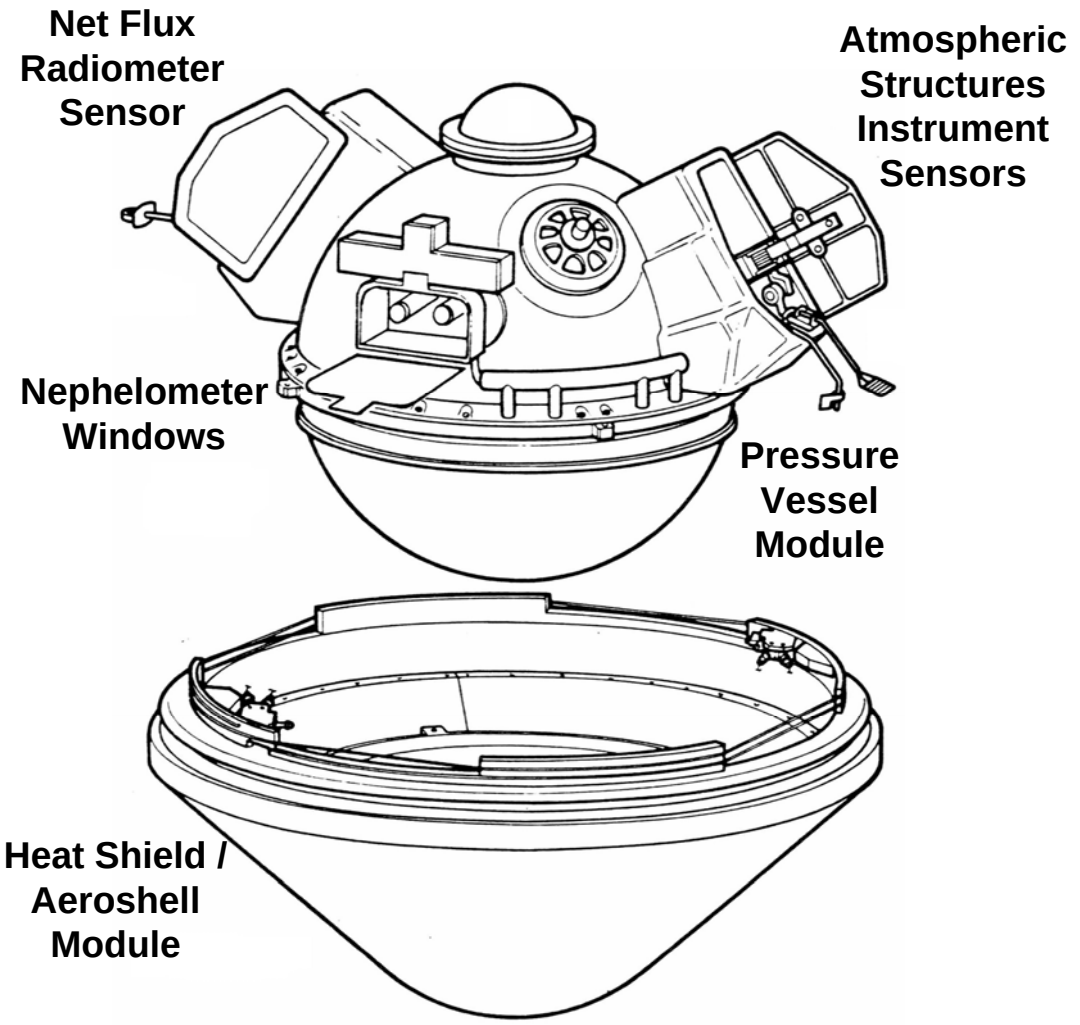
- **Pressure Vessel**
  - **79 cm diameter**
- **Aeroshell**
  - **142 cm diameter**
  - **45º blunt cone**



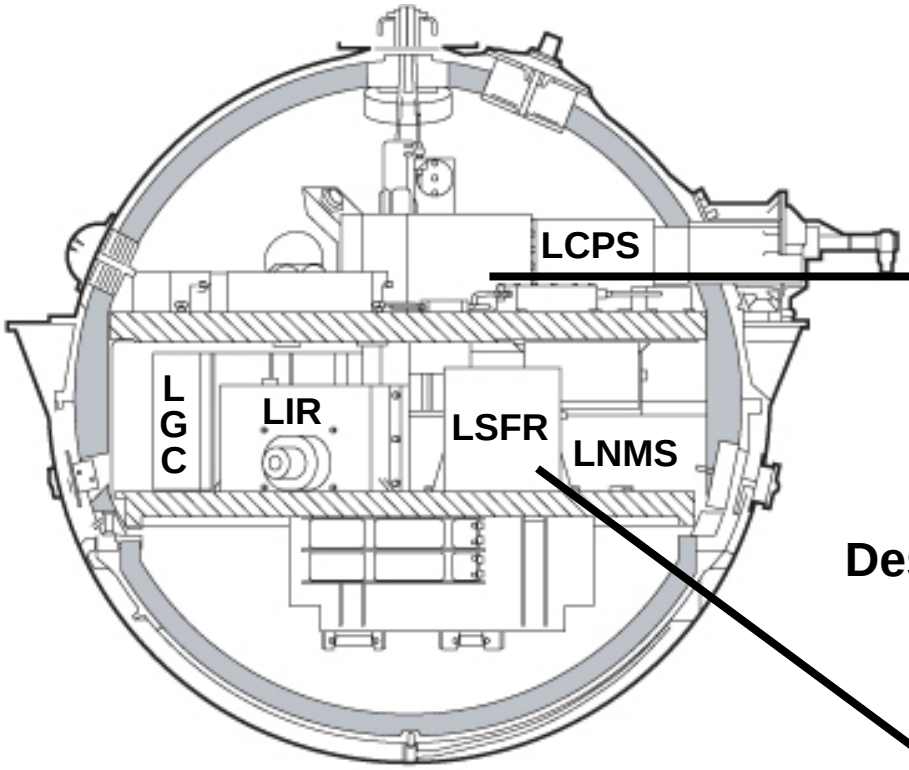


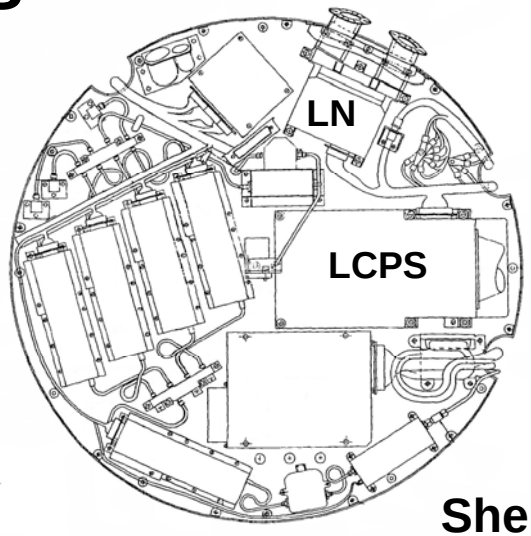
Pioneer Venus Small Probe Design

- **Pressure Vessel**
  - 47 cm diameter
- **Aeroshell**
  - 76 cm diameter
  - 45º blunt cone



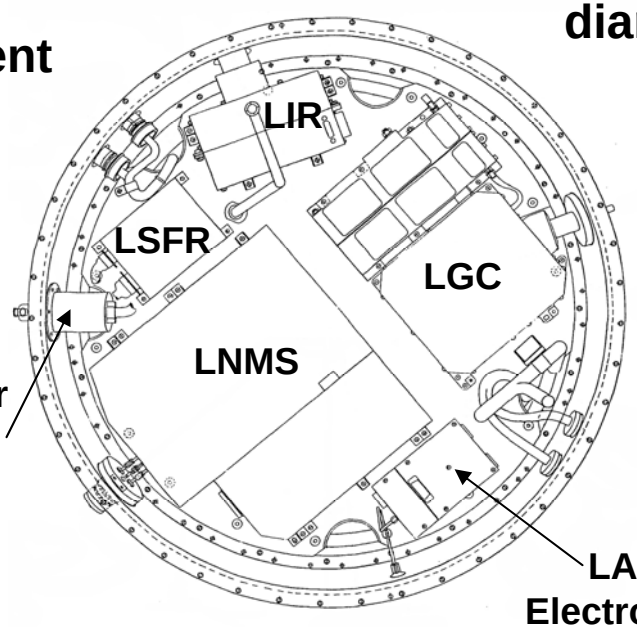
Pioneer Venus Large Probe Instruments





Shelves 65 cm diameter

Descent

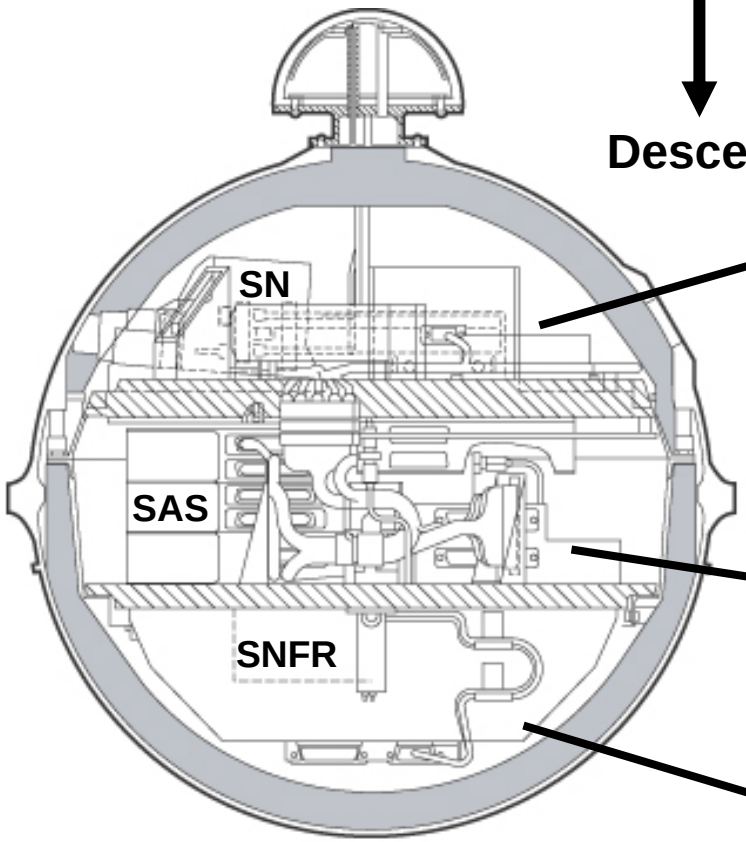


LSFR Sensor

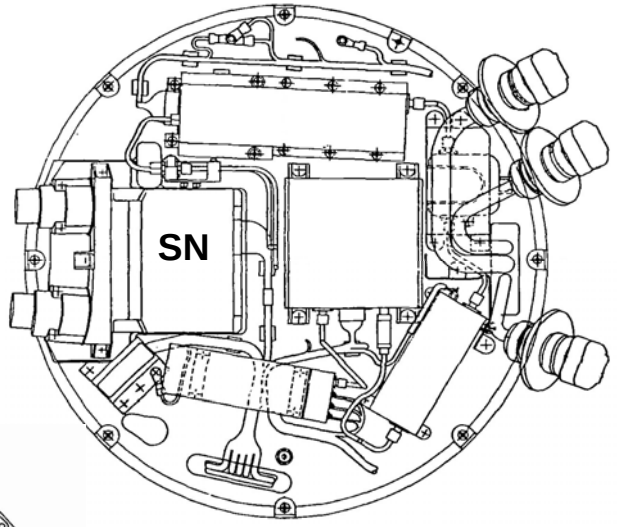
LAS Electronics

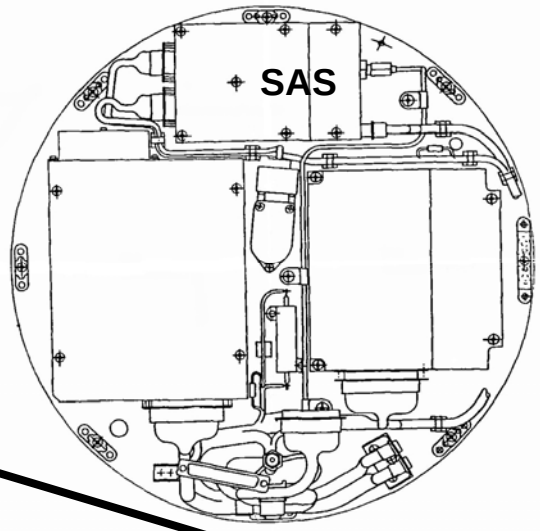
LAS	Atmospheric structures
LN	Nephelometer
LCPS	Cloud particle size spectrometer
LIR	Infrared radiometer
LNMS	Neutral mass spectrometer
LGC	Gas chromatograph
LSFR	Solar flux radiometer

Pioneer Venus Small Probe Instruments

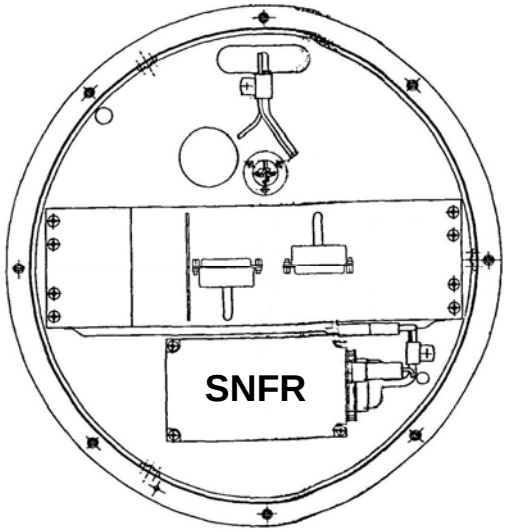


Descent





Shelves 39 cm diameter

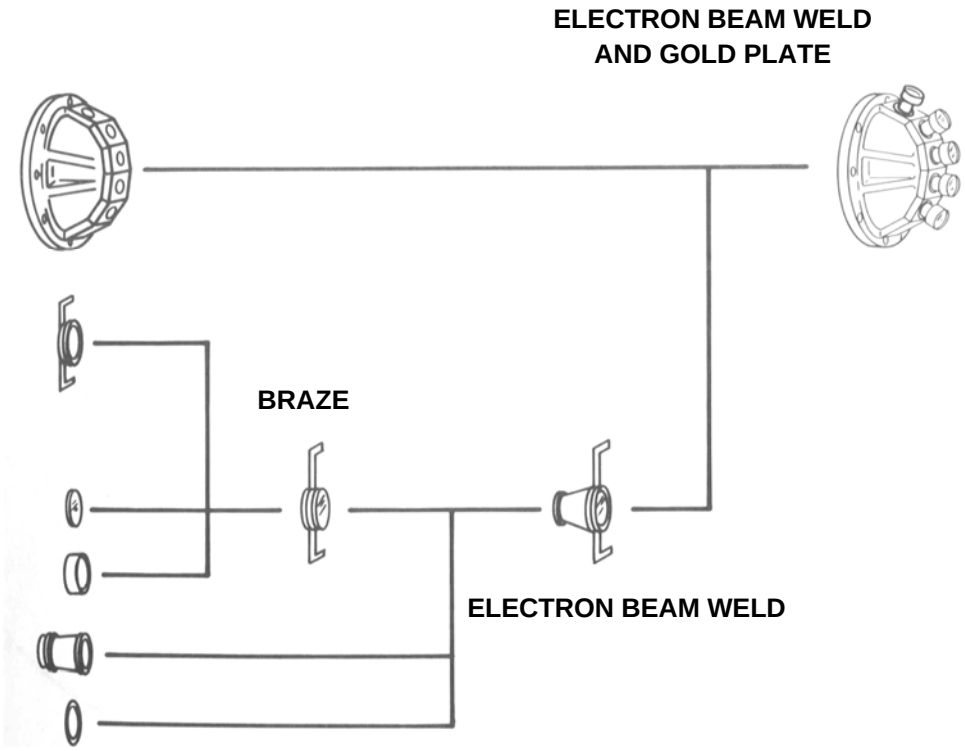


SAS Atmospheric structures
SN Nephelometer
SNFR Net flux radiometer

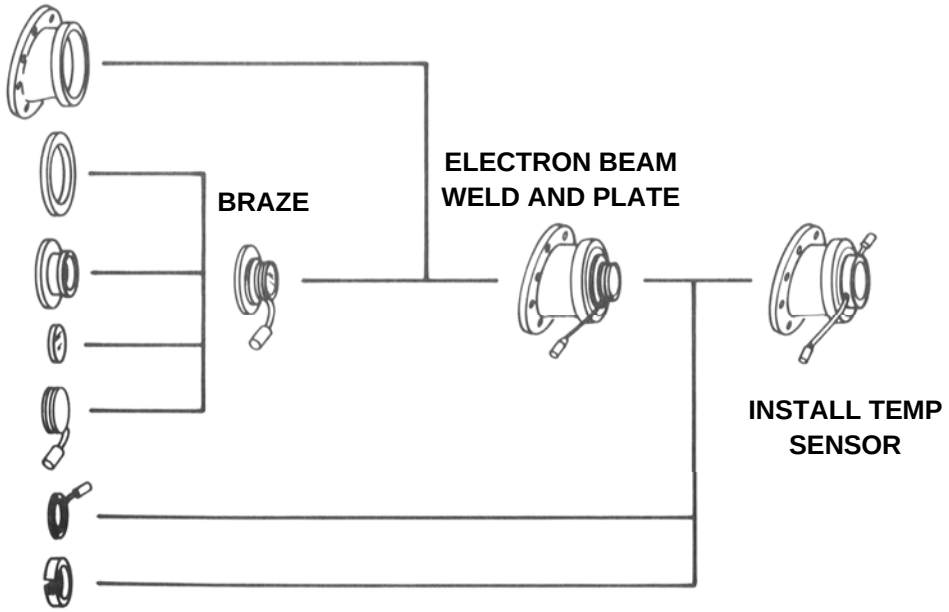
Pioneer Venus Window Summary

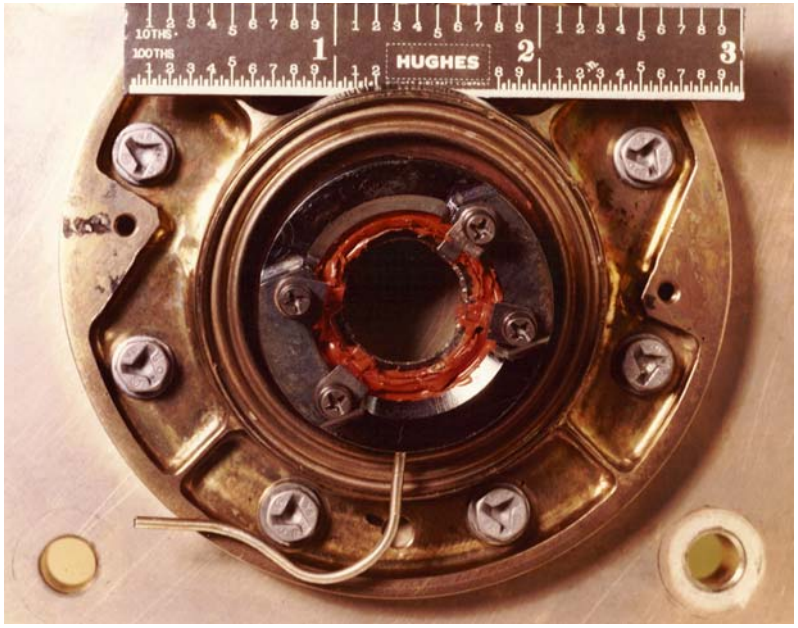
Probe	Instrument	Windows	Material	Diameter (mm)	Thickness (mm)
LP, SP	Nephelometer	2	Sapphire	33.8	8.0
LP	Cloud Particle Size Spectrometer	1	Sapphire	38.6	6.2
LP	Solar Flux Radiometer	5	Sapphire	9.5	2.0
LP	Infrared Radiometer	1	Diamond	15.4	2.5

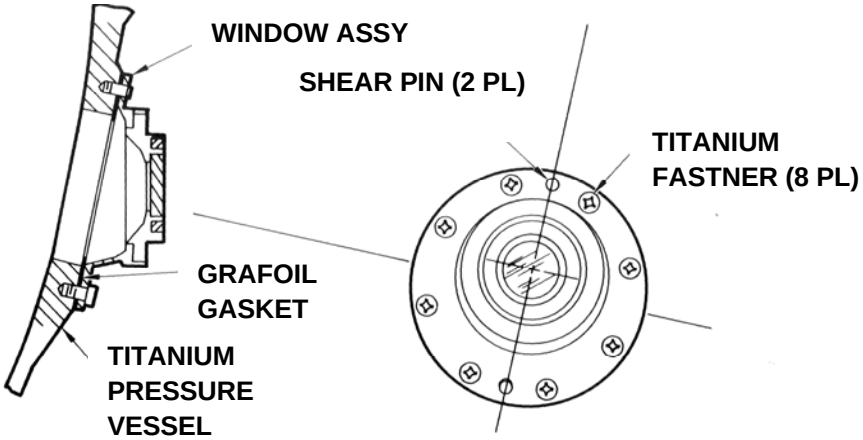
Large Probe LSFR Window

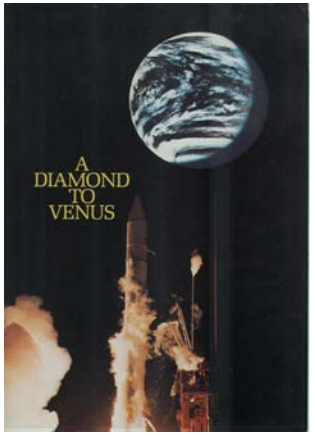


Large Probe LIR Window

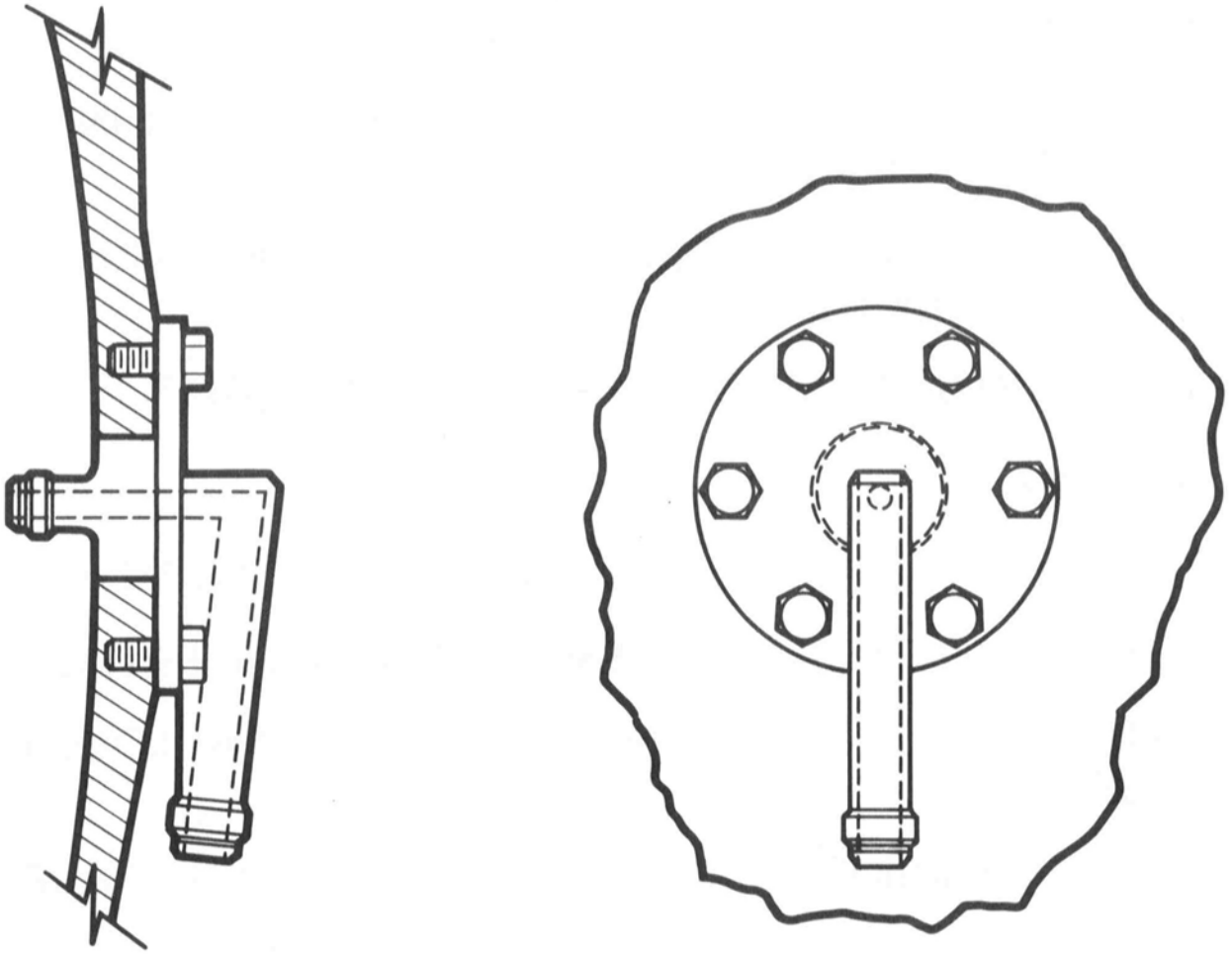






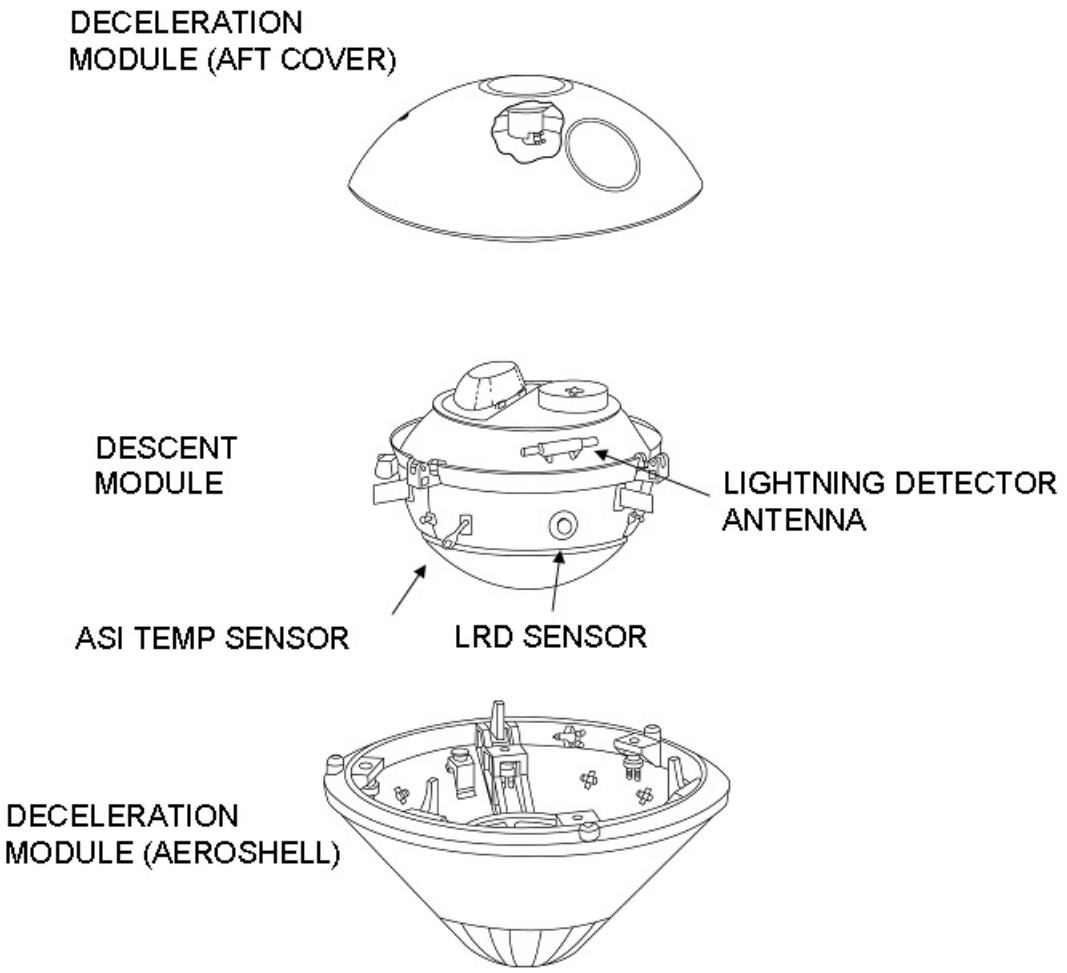


Large Probe Pressure Inlet

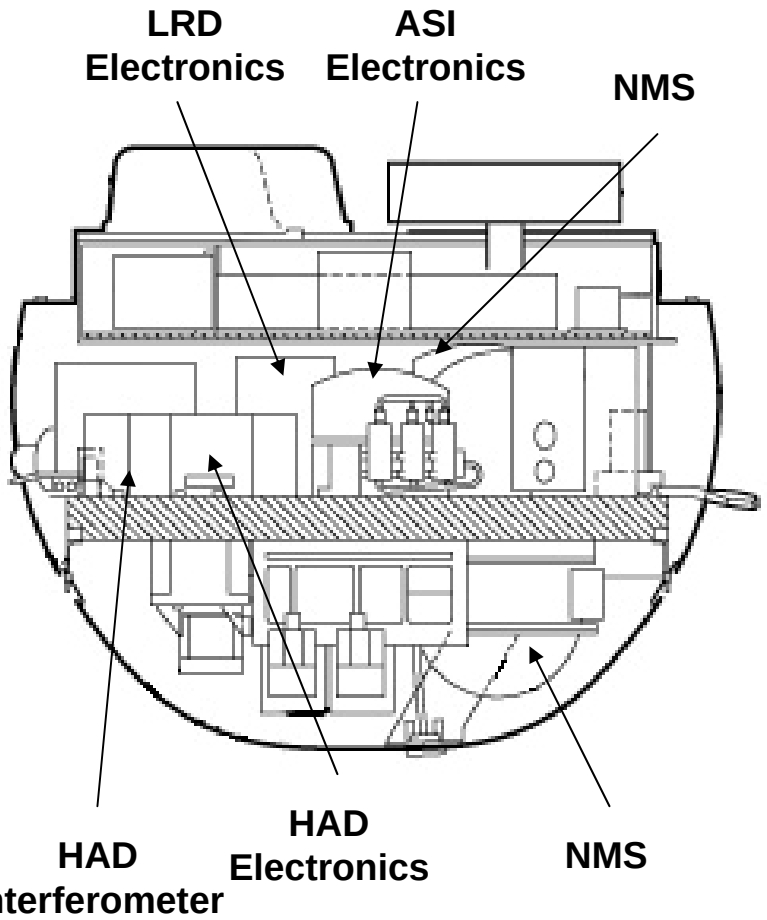


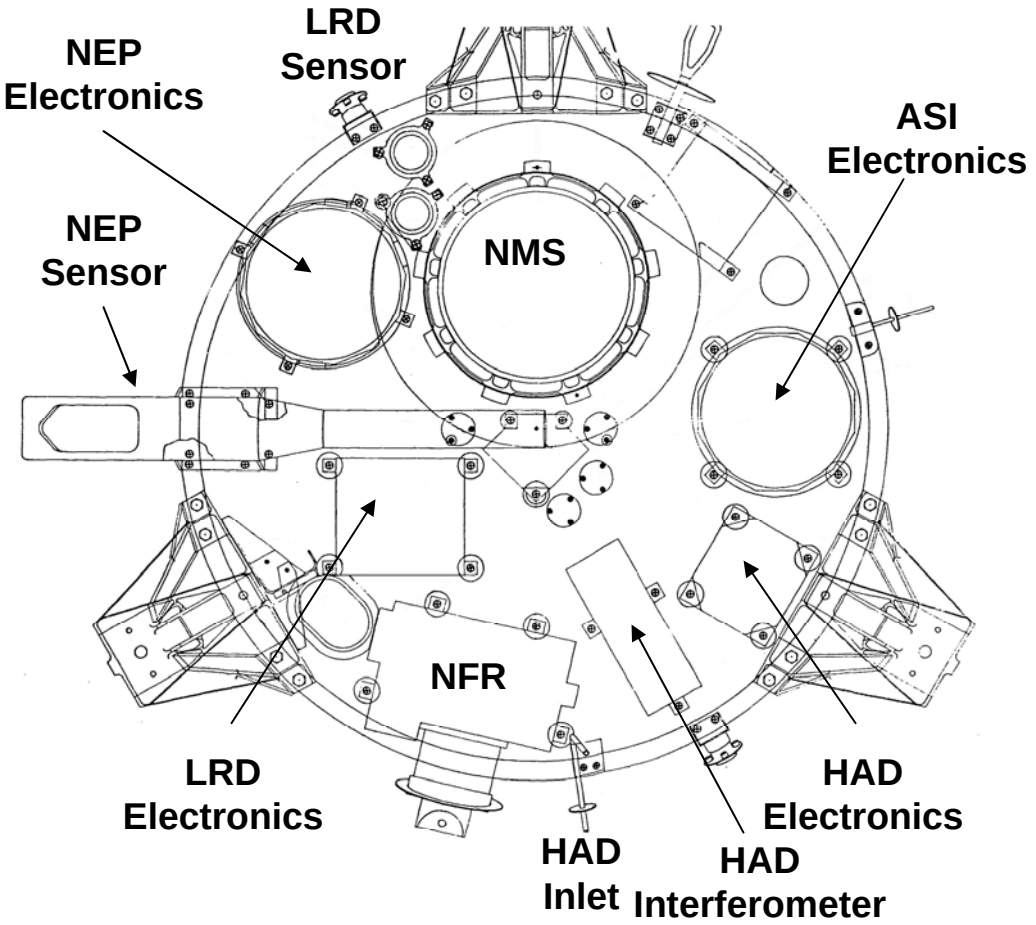
Galileo Probe Major Elements

- **Descent Module**
  - **66 cm diameter**
- **Aeroshell**
  - **126 cm diameter**
  - **45º blunt cone**



Galileo Probe Instruments





ASI Atmospheric structures inst
NEP Nephelometer
HAD Helium abundance detector
NFR Net flux radiometer

NMS Neutral mass spectrometer
LRD Lightning and radio emission detector
EPI Energetic particle instrument

Conclusions

- Probe instrument accommodation requires a close working relationship between the PI(s), instrument designers and probe engineering team
- Early definition of mechanical interfaces is critical
- Key considerations are instrument accommodation and integration
- Extremely limited probe resources drive innovative solutions to resolve tough problems
- Future probe mission success must leverage lessons learned from past missions